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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/700,339	Applicant(s) CHODACKI ET AL.	
	Examiner Carl D. Price	Art Unit 3749	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06/23/2010 (RCE)*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6,16,17 and 32-39* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6,16,17 and 32-39* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date ____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on **06/23/2010** has been entered.

Response to Arguments

Applicant's arguments with respect to **claims 1-6, 16, 17** and **32-39** have been considered but are moot in view of the new ground(s) of rejection.

Applicant has amended the claims to be of a scope not previously considered. Consistent with applicant's argument that the prior art relied on in the previous office action fail to show, disclose and/or teach certain aspects of applicant's invention now recited in the claims filed on **06/23/2010**, applicant has amended the claims to include at least the following:

In response to the prior art of record cited in the previous examiner's action and in support of the scope of the invention now presented in the amended claims, applicant argues the following:

> "Without agreeing with or acquiescing to the rejections, Applicants have further amended the claims so as to set out that the control device is configured and arranged so that following successful ignition of the gas, **voltage and current applied to the igniter are controlled** so the electric resistance ceramic igniter is maintained at a temperature less than the gas ignition temperature but above room temperature, **and so that upon detection of a loss of flame the electric resistance ceramic igniter is re-heated so as to re-ignite the gas within about 4 second or less.** It is submitted that none of the references when taken alone or in combination teach or suggest such a control system." (Bolding and Highlighting added)

In response to applicant's argument(s) directed to the prior art previously relied on, and in response to the scope of the invention now set forth in the presently amended claims, the following examiner's action now relies on the prior art reference(s) of **US 5725368 (Arensmeier)** in view of **US 5233166 (Maeda et al)** or **US 5997998 (Sawamura)** and in view of **US005899684 (McCoy et al).**

US 5725368 (Arensmeier) shows and discloses a gas fired appliance including a system provided for applying power to an electrical resistance igniter for energizing the igniter to ignition temperature within approximately 2 seconds and for maintaining the igniter at ignition temperature for an additional time period while preventing the igniter from attaining a temperature which could damage the igniter. To achieve this end **US 5725368 (Arensmeier) utilizes a <u>microcomputer to determine the resistance of igniter 12.</u>** In this regard **US 5725368 (Arensmeier)** acknowledges the relationship between the resistance of igniter as being equal to E/I where E is the voltage across igniter 12 which is essentially equal to the determined line voltage across terminals 14 and 16 minus the measured voltage across resistor R1, **<u>and wherein I is the current</u>** through igniter 12 which is equal to the measured voltage across resistor R1 divided by the known value of resistor R1. This determined resistance value is referred to as the "cold" resistance.

US 5233166 (Maeda et al) discloses that at the time of the invention electric resistance ceramic igniters were known as suitable means to ignite kerosene or oil fan heater and various gas combustion apparatuses. More specifically, **US 5233166 (Maeda et al)** employs ceramic sintered silicon nitride matrix material to form an electrical resistance igniter capable of achieving quick heating performance; about one second was required to reach 1,000.degree. C. (See Table 2) and which is usable continuously for an extended period of time at high temperatures exceeding 1,400.degree. C., is superior in oxidation resistance and durability, and excellent in quick temperature rising characteristics.

US 5997998 (Sawamura) disclose that at the time of the invention sintered silicon nitride ceramic resistance elements were known to be capable of being rapidly heated up to 1100.degree. C. or more within about 3 seconds, to have excellent durability withstanding the

repetition of the temperature rise and oxidation in a high temperature of about 1500 to 1550.degree. C. in air, and to be used for the ignition of a gaseous fuel or a liquid fuel.

US 5899684 (McCoy et al) disclose that sintered silicon nitride ceramic resistance elements (i.e. - hot surface ignition systems (HIS)) were known at the time of the invention as gas ignition means in units such as gas clothes dryers, gas ovens, gas fired furnaces, and boilers thus replacing and eliminating standing gas pilot lights. **US 5899684 (McCoy et al)** provide full-wave DC voltage during STARTUP. Thus, the igniter 14 is maintained at half power during normal RUN operations to reduce carbon buildup on the igniter electrode and has full power applied thereto during start operations. **US 5899684 (McCoy et al)** discloses the use of a high performance sintered ceramic hot surface igniters, capable of operating at very high temperatures such as 1,300 to 1,600 degrees Celsius. **US 5899684 (McCoy et al)** discloses the temperature of said hot surface igniter varies with the applied voltage and some variation is found in normal response variations among the igniters themselves. **US 5899684 (McCoy et al)** further discloses solving this problem by providing a circuit that responds to both current and voltage applied to the hot surface igniter.

Accordingly, while applicant's arguments have been carefully considered, applicant's claims do not patentably distinguish applicant's invention over the prior art of record.

See the examiner's action herein below.

Claim Objections

Claim 2 is objected to because of the following informalities: In line 6, "ate" should be - - at - -. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 2 and 4 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 2 the recitation is unclear what, if any, relationship the time period recited in the recitation "is less than a desired time period for re-ignition" might have with the previously defined "about.2 second or less" (claim 1). In regard to the recitation of the time period, the recitation of claim 2 appears to broaden, rather than narrow, the desired time period for re-ignition (i.e. - a time required to reheat the electric resistance ceramic igniter).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims: Rejected under 35 U.S.C. 103(a)

Claims 1-6, 16, 17 and **32-39** are rejected under 35 U.S.C. 103(a) as being unpatentable over **US 5725368 (Arensmeier)** in view of **US 5233166 (Maeda et al)** or **US 5997998 (Sawamura)** and **US 5899684 (McCoy et al)**.

US 5725368 (Arensmeier) shows and discloses a gas fired appliance ignition system including a system provided for applying power to an electrical resistance igniter for energizing the igniter to **ignition temperature** within approximately **2 seconds and for maintaining the igniter at ignition temperature for an additional time period** while preventing the igniter from attaining a temperature which could damage the igniter. To achieve this end **US 5725368 (Arensmeier)** utilizes **a microcomputer control device** to determine the resistance of igniter 12. In this regard **US 5725368 (Arensmeier)** acknowledges the known relationship between the resistance of the igniter as being equal to E/I where E is the voltage across igniter 12 which is essentially equal to the determined line voltage across terminals 14 and 16 minus the measured voltage across resistor R1, and wherein I is the current through igniter 12 which is equal to the measured voltage across resistor R1 divided by the known value of resistor R1. This determined resistance value is referred to as the "cold" resistance.

US 5725368 (Arensmeier) discloses:

> (2) Referring to FIG. 1, shown therein is a system 10 for controlling energizing of a **silicon nitride igniter 12.** System 10 is connected to terminals 14 and 16 of a conventional 240 volt alternating current power source.
>
> (3) Igniter 12 is connected at one end to terminal 14 through a triac Q1, a set of normally-open relay contacts K1, and a switch 18, and at the other end to terminal 16 through a 1 ohm resistor R1. Switch 18 is a manually-operated switch which is moved to an ON position whenever operation of control system 10 is desired.
>
> (4) Igniter 12 is effective, when sufficiently heated, to ignite gas emitted from a burner 20. The flow of gas to burner 20 is controlled by a valve 22 in a gas conduit 24 leading from a gas source (not shown) to burner 20. A valve winding 26, which controls valve 22, is connected at one end to terminal 14 through a set of normally-open contacts K2, contacts K1, and switch 18, and at the other end to terminal 16.
>
> (13) In accordance with the invention, a system is provided for applying power to an electrical resistance igniter for energizing the igniter to ignition temperature **within approximately 2 seconds** and **for maintaining the igniter at ignition temperature** for

an additional time period while preventing the igniter from attaining a temperature which could damage the igniter. The system includes a microcomputer which determines the level of power to be applied to the igniter based on the value of the voltage available to energize the igniter and on the value of the resistance of the igniter. A triac in series with the igniter is fired in an irregular firing sequence which causes the level of power to the igniter to be time-varying. In a first embodiment, the firing sequence is determined from a look-up table in the ROM of the microcomputer. In a second embodiment, the firing sequence is determined by a comparison of the igniter temperature, as it is being heated, with a predetermined varying temperature setpoint.

(25) The second embodiment provides for firing triac Q1 as much as every line cycle when the igniter temperature is not greater than the setpoint temperature, and as little as every fourth line cycle when the igniter temperature is greater than the setpoint temperature. It is noted that firing triac Q1 at least every fourth line cycle enables a determination of the **"hot" resistance of igniter 12** at least every fourth line cycle. As in the first embodiment, the result of such an irregular firing pattern is the application of time-varying power to igniter 12 which enables igniter 12 to attain **ignition temperature within 2 seconds** and to do so without exceeding a temperature which could damage it.

(13) In logic step 106, **microcomputer M1, at pin PC4, measures the voltage at junction 30 and determines therefrom the value of the line voltage across terminals 14 and 16**. Also, microcomputer M1, at pin PB7, measures the voltage at junction 38 which is the voltage across resistor R1. **Microcomputer M1 then determines the resistance of igniter 12.** Specifically, the resistance of igniter 12 is equal to E/I where E is the voltage across igniter 12 which is essentially equal to the determined line voltage across terminals 14 and 16 minus the measured voltage across resistor R1, **and I is the current** through igniter 12 which **is equal to the measured voltage across resistor R1 divided by the known value of resistor R1**. This determined resistance value is referred to as the "cold" resistance.

US 5725368 (Arensmeier) claims the invention substantially as set forth in the claims with possible exception to:

- the gas burner and burner ignition system being applied to heated appliance units such as gas clothes dryers, gas ovens, gas fired furnaces, and boilers thus replacing and eliminating standing gas pilot lights.
- the use of a ceramic silicon nitride electric resistance igniter capable of being heated to re-ignition temperature within about at least 2 seconds or less; and
- means associated with the controller to selectively switch and/or control the electric resistance igniter on voltage and current so as to ensure rapid or quick

re-heating of the igniter to a re-ignition temperature within about at least 2 seconds or less.

US 5233166 (Maeda et al) discloses that at the time of the invention electric resistance **ceramic sintered bodies of silicon nitride** igniters were known as suitable means to ignite kerosene or oil fan heater and various gas combustion apparatuses. More specifically, **US 5233166 (Maeda et al)** employs ceramic sintered silicon nitride matrix material to form an electrical resistance igniter capable of achieving quick heating performance; about one second was required to reach 1,000.degree. C. (See Table 2) and which is usable continuously for an extended period of time at high temperatures exceeding 1,400.degree. C., is superior in oxidation resistance and durability, and excellent in quick temperature rising characteristics.

US 5233166 (Maeda et al) discloses:

> (11) However if the above-mentioned ceramic heater 12 is used to **ignite kerosene or oil fan heater or to** generate high temperatures exceeding 1,300.degree. C., the ceramic heater is required to have durability at such high temperatures exceeding 1,300.degree. C. to achieve positive ignition, stability and reliability. In particular, when the **ceramic heater 12 is used to ignite various gas combustion apparatuses,** the heater is requested to have even higher heat resistance at temperatures exceeding 1,400.degree. C. and quick temperature rising characteristics represented by an ignition temperature reaching period of **not more than 3 seconds.** In an electricity application cycle test wherein each cycle consists of **a quick temperature rising period** during which 1,500.degree. C. is reached within 10 seconds after AC voltage regulated to saturate at 1,500.degree. C. for example is applied and a constant electricity application stop period, the ignition heater used for this test is required to withstand 10,000 cycles. The above-mentioned ceramic heater 12 cannot satisfy the specified characteristics for the electricity application cycle test. The main heating element 10 of the ceramic heater 12 may be broken or its resistance may be changed. In addition, the silicon nitride sintered body 11 itself, used as the substrate of the ceramic heater 12, tends to oxidize. For these problems, the above-mentioned ceramic heater 12 lacks in durability and reliability when used as a source for ignition and heating at high temperatures. Furthermore, the ceramic heater 12 cannot shorten the time required to reach 1,000.degree. C. to 5 seconds or less.
>
> (13) The present invention **has been developed to eliminate the above-mentioned defects** of the prior art. The object of the present invention is to provide a ceramic heater which is usable continuously for an extended period of time at **high temperatures exceeding 1,400.degree. C.,** superior in oxidation resistance and durability, and excellent in **quick temperature rising characteristics.**

(14) The present invention provides a ceramic heater comprising **a ceramic sintered body** of **silicon nitride matrix** and a heating resistor of an inorganic conductor embedded in the sintered body, wherein the **ceramic sintered body of silicon nitride matrix** comprises 8 to 19 weight % of a rare earth element when calculated by conversion in terms of the amount of oxide, 2 to 7 weight % of silicon oxide (SiO.sub.2) and 7 to 20 weight % of molybdenum silicide or titanium nitride.

(13) As **clearly indicated in Table 2,** it was confirmed that the high-temperature durability of all the ceramic heater samples of the present invention was not less than 20,000 cycles and that no oxidation was found on the surfaces of the **ceramic sintered bodies of silicon nitride matrix**. In addition, all the ceramic heater samples of the present invention achieved **quick heating performance;** about **one second** was required to reach 1,000.degree. C.

US 5997998 (Sawamura) teaches from applicant's same gas fired appliance ignition system field of endeavor, that sintered silicon nitride ceramic resistance elements were known at the time of the invention to be capable of being rapidly heated up to 1100.degree. C. or more within about 3 seconds, to have excellent durability withstanding the repetition of the temperature rise and oxidation in a high temperature of about 1500 to 1550.degree. C. in air, and to be used for the ignition of a gaseous fuel or a liquid fuel.

US 5997998 (Sawamura) disclose:

(2) The present invention relates generally to a novel resistance element, and more particularly, it relates to a resistance element such as an **electrifying type resistance element** or a thermistor which can be **rapidly heated up to 1100.degree. C. or more within about 3 seconds** without installing any control circuit applying a computer or the like and which is **excellent in durability**, i.e., which can withstand the repetition of the temperature rise and oxidation in a high temperature of about 1500 to 1550.degree. C. in air and which can be **used for the ignition of a gaseous fuel or a liquid fuel.**

US 5997998 (Sawamura) disclose:

(4) In order to withstand such rapid temperature-rise as to reach 1000.degree. C. or more within about 2 to 3 seconds and a high temperature of about 1500 to 1550.degree. C. in air, this type of resistance element for the ignition is required to have excellent thermal shock resistance and oxidation resistance.

> (5) To meet such a requirement, conventional ceramics resistance elements have been normally manufactured by embedding a heating element such as tungsten or tungsten carbide **in silicon nitride (Si.sub.3 N.sub.4)** and then **sintering** it.

US 5899684 (McCoy et al) teaches from applicant's same gas fired appliance ignition system field of endeavor, that sintered silicon nitride ceramic resistance elements (i.e. - hot surface ignition systems (HIS)) were known at the time of the invention as gas ignition means in units such as gas clothes dryers, gas ovens, gas fired furnaces, and boilers thus replacing and eliminating standing gas pilot lights. **US 5899684 (McCoy et al)** provide full-wave DC voltage during STARTUP. Thus, the igniter 14 is maintained at half power during normal RUN operations to reduce carbon buildup on the igniter electrode and has full power applied thereto during start operations. **US 5899684 (McCoy et al)** discloses the use of a high performance sintered ceramic hot surface igniters, capable of operating at very high temperatures such as 1,300 to 1,600 degrees Celsius. **US 5899684 (McCoy et al)** discloses the temperature of said hot surface igniter varies with the applied voltage and some variation is found in normal response variations among the igniters themselves. **US 5899684 (McCoy et al)** further discloses solving this problem by providing a circuit that responds to both current and voltage applied to the hot surface igniter.

US 5899684 (McCoy et al) discloses:

> (5) In the third embodiment of the present invention, a first circuit is provided that applies full-wave voltage to the ignitor only during the preheat and ignition trial periods for ignition purposes. A second circuit is provided that applies half-wave voltage to the ignitor continuously, beginning with the RUN period, **for fast re-ignition** and **to burn any fuel coming in contact with the ignitor during the RUN period** and **thus prevents carbon buildup on the ignitor,** especially if heavy fuels, such as diesel, are used. A third circuit is provided which automatically adjusts the preheat time and the ignition on-time, depending on the applied line voltage and the current draw of the ignitor.
>
> (12) **Hot surface ignition systems (HSI)** have **been used for more than twenty years for gas ignition in units** such as **gas clothes dryers**, **gas** ovens, **gas** fired furnaces, and boilers thus replacing and eliminating standing gas pilot lights. Low voltage ignitors (12 and 24 volts) of the hot surface type are made from a patented ceramic/intermetallic material. These ignitors are used in compact low wattage assemblies **for ignition of gas fuels**. The element reaches ignition temperature in less than 10 to 15 seconds and utilizes

about 40 watts of power. The ignitor is made from a composite of strong oxidation resistant ceramic and a refractory intermetallic. Thus hot surface ignitors have no flame or spark. They simply heat to the required temperature for igniting a fuel air mixture. Such ignitors have not been used in oil burning systems because the ignitor material is porous and oil entering the porous cavities causes buildup of the materials that are inimical to the operation of the burner.

(13) A **120 V HSI ignitor** has been developed in which the material is compressed and **sintered** to full density leaving no porosity **resulting in a high performance ceramic composite**. It can **operate at very high temperatures such as 1,300 to 1,600 degrees Celsius**. This same ignitor can withstand 230-volt operation at a reduced duty cycle to prevent overheating. The application of such high voltage hot surface ignition device is especially attractive for use in the present invention wherein fuel oil burning heaters are to be constructed. They provide unique advantages over prior art gas flames, heating coils, and spark gap ignition systems. However, the temperature of said hot surface ignitor varies with the applied voltage and some variation is found in normal response variations among the ignitors themselves.

(14) This **invention solves this problem by providing a circuit that responds to both current and voltage applied to the hot surface igniter** and is also used to operate a 120-volt igniter directly on 230 volts or operate a 60-volt hot surface igniter from a 60 to 132 volts AC source without a step-down transformer or series connected power dissipating devices.

(24) The present invention relates to an improvement to commonly assigned U.S. Pat. No. 5,567,144 by Hugh W. McCoy entitled "HOT SURFACE IGNITION CONTROLLER FOR OIL BURNER" and incorporated herein by reference in its entirety. In the first embodiment, the present invention adds a 120 or 230 volt half-wave **power regulator circuit that responds to both the igniter current and voltage to operate a 60-volt igniter on 120 volts half wave or to operate a 120-volt igniter on 230 volts half wave**, and includes a preregulator and regulator power supply circuits and adds a third switching circuit to power a motor auxiliary start winding. The invention also includes a fuel oil-type burner having a hot surface ignitor element that is manufactured to full density with no porosity. A blower provides air to the combustion chamber and an AC-to-DC half-wave converter circuit converts AC power to DC voltage output. A preregulator stores excess voltage for use during the undriven half cycle. A DC voltage regulator generates a DC output voltage of approximately 11 volts for operating a control circuit.

"(17) ...Therefore, **the current and voltage dependent ignitor power regulator circuit 67** is a half-wave voltage phase regulator that averages the duty cycle of the voltage supplied to the hot surface ignitor 14. **With proper selection of component values, a near constant power will be provided to drive ignitor 14.** Also, if a low tolerance ignitor is used, the lower average current will cause the NAND gate 63 to switch OFF IGBT 21 at a higher line voltage level thus boosting the power applied to the ignitor and

bringing the ignition temperature up to the normal value. Also, line voltage dips when the blower motor 16 is energized and blows air over the ignitor, which tends to cool it down some. The **power regulator circuit 67 will keep the ignitor energized**, at its nominal operating power, under reduced line voltage thus helping to maintain a constant temperature output from the ignitor 14. As described above, half-wave AC line voltage is applied to the ignitor 14 and begins the preheat stage of operation at time point "A" in FIGS. 4 and 5."

(28) After approximately **31/2 seconds,** the **ignitor preheat time,** third NAND gate 46 turns ON triac 15 in the blower motor drive circuit 22 which delivers AC line voltage to the main winding of the motor 16. NAND gate 42 causes turn ON of triac 62 in the motor start drive circuit 61, which delivers 120 volts AC RMS to the start winding of the motor 16. From this point the ignitor 14 remains ON for approximately 21/2 more seconds, which is the ignition trial period, as shown in FIGS. 4 and 5 to be between points "B" and "C", prior to being turned OFF by the dissipation of the first time constant circuit 32.

(38) The **third embodiment shown in FIG. 8 and FIG. 9** is **essentially as the first and second embodiments with certain additions and changes**. FIG. 8 is a schematic block diagram of the third embodiment of the novel fuel oil-type burner 10 illustrating the combustion chamber in phantom lines in which is positioned a hot surface ignitor 14. Blower motor 16 not only provides the air for the combustion chamber 12, but, as stated previously, also provides the fuel oil to the combustion chamber in a well-known manner. **An ignitor driver 20 forms a first switch that is coupled to the hot surface ignitor 14 to selectively couple half-wave or full-wave rectified AC line voltage from source 24 on line 25 through triac 3 (FIG. 9) to the ignitor 14.** As can be seen in FIG. 9, triac 3 is biased ON during the positive half cycle by diode 66 continuously during normal operations and is biased ON during the negative half cycle by optical isolator 23 (OC2) **to provide full-wave DC voltage during STARTUP**. Thus, the **ignitor 14 is maintained at half power during normal RUN operations to reduce carbon buildup on the ignitor electrode and has full power applied thereto during start operations.** In like manner, motor driver switches 22 and 61 (FIG. 8 and FIG. 9) form second and third switches, respectively, that selectively couple the alternating current voltage on line 25 to the blower motor 16 to provide the fuel and air to the combustion chamber 12.

In regard to **claims 1-6, 16, 17** and **32-39,** for the same purpose of providing a suitable quick response electric resistance silicon nitride igniter and/or igniter material suitable as a quick response igniter (i.e. – capable of being heated to ignition temperature within about 4 seconds or less), it would have been obvious to a person having ordinary skill in the art at the time of the invention to substitute a sintered ceramic silicon nitride igniter for **US 5725368 (Arensmeier)** the silicon nitride, in view of the teaching(s) of **US 5233166 (Maeda et al)** and/or **US 5997998 (Sawamura)**. Also, in regard to **claims 1-6, 16, 17** and **32-39,** for the purpose of aiding in

assuring fast re-ignition and to suitably regulate the temperature of the igniter, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the ignition control system of **US 5725368 (Arensmeier)** to operate at full-wave DC voltage to achieve ignition temperature during STARTUP and to maintain the igniter at half power necessarily resulting in a lower temperature, between room temperature and the ignition temperature, during normal RUN operations, and providing a circuit that responds to both current and voltage applied to the hot surface igniter, in view of the teaching of **US 5899684 (McCoy et al).**

In regard to **claim 2**, the igniter of **US 5899684 (McCoy et al)** is placed into the lower temperature half power operating condition only in response to a flame test period in which, if no flame is apparent, the system otherwise shuts down. As such, the control device is configured and arranged so as to selectively control energization of the electric resistance ceramic igniter following successful ignition of the gas. To therefore further provide the ignition control system of **US 5725368 (Arensmeier)** with such a selective means it would have further been obvious to a person having ordinary skill in the art at the time of the invention, in view of the teaching of **US 5899684 (McCoy et al).** Furthermore, with regard to claim 2, Official Notice is taken that it is known to configure and arrange burner control system control devices so as to open the one or more gas valves only after the control device determines that the electric resistance ceramic igniter is heated to a temperature ate least equal to the gas ignition temperature, as a means to ensure proper conditions for ignition have been met at the time fuel is introduced (see for example**: US 3584987, US 6216683**). As such, in view of that which is well known, it would have been obvious to a person having ordinary skill in the art at the time of the invention to operate the ignition controller of **US 5725368 (Arensmeier).**

In regard to **claims 3-6**, **US 5725368 (Arensmeier)** alone utilizes a switching mechanism operably connected between the electric resistance ceramic igniter and the power source; a micro-controller and an applications program for execution in the micro- controller; and wherein the applications program includes instructions and criteria for outputting control signals to the switching mechanism to selectively control voltage and current being applied to the electric resistance ceramic igniter. As such, it would have been obvious to a person having ordinary skill in the art at the time of the invention to likewise utilize these aspects of the US

5725368 (Arensmeier) control system when applying the teachings of **US 5899684 (McCoy et al).**

In regard to **claims 16, 17, 32-34, 37** and **39,** for the purpose of applying the gas burner and its ignition control arrangement to a suitable application or use, it would have been obvious to a person having ordinary skill in the art at the time of the invention to apply or use the **US 7148454 (Chodacki et al.)** gas burner and ignition control as modified by **US 5233166 (Maeda et al)** or **US 5997998 (Sawamura)** and **US 5899684 (McCoy et al)** for at least one of a gas-fired stove, oven, or water-heater, in view of the teaching of **US 5899684 (McCoy et al)**.

In regard to **claim 35**, Official Notice is taken that it is known to operate gas burner system with propane as the source of combustible fuel gas. Therefore, in view of that which well known it would have been obvious operate **US 5725368 (Arensmeier)** with a gas such as propane.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned

with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 1-6, 16, 17 and **32-39** are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over **claims 1-36** of U.S. Patent No. **7148454 (Chodacki et al.)** in view of **US 5233166 (Maeda et al)** or **US 5997998 (Sawamura)** and **US 5899684 (McCoy et al)**.

US 7148454 (Chodacki et al.) claims the invention substantially as set forth in the claims with possible exception to:

- the gas burner and burner ignition system being applied to heated appliance units such as gas clothes dryers, gas ovens, gas fired furnaces, and boilers thus replacing and eliminating standing gas pilot lights.
- the use of a ceramic silicon nitride electric resistance igniter capable of being heated to re-ignition temperature within about at least 2 seconds or less; and
- means associated with the controller to selectively switch and/or control the electric resistance igniter on voltage and current so as to ensure rapid or quick re-heating of the igniter to a re-ignition temperature within about at least 2 seconds or less.

US 5233166 (Maeda et al) discloses that at the time of the invention electric resistance **<u>ceramic sintered bodies of silicon nitride</u>** igniters were known as suitable means to ignite kerosene or oil fan heater and various gas combustion apparatuses. More specifically, **US 5233166 (Maeda et al)** employs ceramic sintered silicon nitride matrix material to form an electrical resistance igniter capable of achieving quick heating performance; about one second was required to reach 1,000.degree. C. (See Table 2) and which is usable continuously for an

extended period of time at high temperatures exceeding 1,400.degree. C., is superior in oxidation resistance and durability, and excellent in quick temperature rising characteristics.

US 5997998 (Sawamura) teaches from applicant's same gas fired appliance ignition system field of endeavor, that sintered silicon nitride ceramic resistance elements were known at the time of the invention to be capable of being rapidly heated up to 1100.degree. C. or more within about 3 seconds, to have excellent durability withstanding the repetition of the temperature rise and oxidation in a high temperature of about 1500 to 1550.degree. C. in air, and to be used for the ignition of a gaseous fuel or a liquid fuel.

US 5899684 (McCoy et al) teaches from applicant's same gas fired appliance ignition system field of endeavor, that sintered silicon nitride ceramic resistance elements (i.e. - hot surface ignition systems (HIS)) were known at the time of the invention as gas ignition means in units such as gas clothes dryers, gas ovens, gas fired furnaces, and boilers thus replacing and eliminating standing gas pilot lights. **US 5899684 (McCoy et al)** provide full-wave DC voltage during STARTUP. Thus, the igniter 14 is maintained at half power during normal RUN operations to reduce carbon buildup on the igniter electrode and has full power applied thereto during start operations. **US 5899684 (McCoy et al)** discloses the use of a high performance sintered ceramic hot surface igniters, capable of operating at very high temperatures such as 1,300 to 1,600 degrees Celsius. **US 5899684 (McCoy et al)** discloses the temperature of said hot surface igniter varies with the applied voltage and some variation is found in normal response variations among the igniters themselves. **US 5899684 (McCoy et al)** further discloses solving this problem by providing a circuit that responds to both current and voltage applied to the hot surface igniter.

In regard to **claims 1-6, 16, 17** and **32-39,** for the same purpose of providing a suitable quick response electric resistance silicon nitride igniter and/or igniter material suitable as a quick response igniter (i.e. – capable of being heated to ignition temperature within about 4 seconds or less), it would have been obvious to a person having ordinary skill in the art at the time of the invention to substitute a sintered ceramic silicon nitride igniter for **US 7148454 (Chodacki et al.)** the electric resistance igniter, in view of the teaching(s) of **US 5233166 (Maeda et al)** and/or **US 5997998 (Sawamura)**. Also, in regard to **claims 1-6, 16, 17** and **32-39,** for the purpose of

aiding in assuring fast re-ignition and to suitably regulate the temperature of the igniter, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the ignition control system of **US 7148454 (Chodacki et al.)** to operate at full-wave DC voltage to achieve ignition temperature during STARTUP and to maintain the igniter at half power necessarily resulting in a lower temperature, between room temperature and the ignition temperature, during normal RUN operations, and providing a circuit that responds to both current and voltage applied to the hot surface igniter, in view of the teaching of **US 5899684 (McCoy et al).**

In regard to **claim 2**, the igniter of **US 5899684 (McCoy et al)** is placed into the lower temperature half power operating condition only in response to a flame test period in which, if no flame is apparent, the system otherwise shuts down. As such, the control device is configured and arranged so as to selectively control energization of the electric resistance ceramic igniter following successful ignition of the gas. To therefore further provide the ignition control system of **US 7148454 (Chodacki et al.)** with such a selective means it would have further been obvious to a person having ordinary skill in the art at the time of the invention, in view of the teaching of **US 5899684 (McCoy et al).** Furthermore, with regard to claim 2, Official Notice is taken that it is known to configure and arrange burner control system control devices so as to open the one or more gas valves only after the control device determines that the electric resistance ceramic igniter is heated to a temperature ate least equal to the gas ignition temperature, as a means to ensure proper conditions for ignition have been met at the time fuel is introduced (see for example**: US 3584987, US 6216683**). As such, in view of that which is well known, it would have been obvious to a person having ordinary skill in the art at the time of the invention to operate the ignition controller of **US 7148454 (Chodacki et al.).**

In regard to **claims 3-6, US 7148454 (Chodacki et al.)** alone utilizes a switching mechanism operably connected between the electric resistance ceramic igniter and the power source; a micro-controller and an applications program for execution in the micro- controller; and wherein the applications program includes instructions and criteria for outputting control signals to the switching mechanism to selectively control voltage and current being applied to the electric resistance ceramic igniter. As such, it would have been obvious to a person having ordinary skill in the art at the time of the invention to likewise utilize these aspects of the **US**

7148454 (Chodacki et al.) control system when applying the teachings of **US 5899684 (McCoy et al).**

In regard to **claims 16, 17, 32-34, 37** and **39,** for the purpose of applying the gas burner and its ignition control arrangement to a suitable application or use, it would have been obvious to a person having ordinary skill in the art at the time of the invention to apply or use the **US 7148454 (Chodacki et al.)** gas burner and ignition control as modified by **US 5233166 (Maeda et al)** or **US 5997998 (Sawamura)** and **US 5899684 (McCoy et al)** for at least one of a gas-fired stove, oven, or water-heater, in view of the teaching of **US 5899684 (McCoy et al)**.

In regard to **claim 35**, Official Notice is taken that it is known to operate gas burner system with propane as the source of combustible fuel gas. Therefore, in view of that which well known it would have been obvious operate **US 7148454 (Chodacki et al.)** with a gas such as propane.

Conclusion

The prior art previously made of record as well as the prior art now cited on the attached USPTO form 892 and not relied upon is considered pertinent to applicant's disclosure.

US 5567144 (McCoy)

> (11) **Hot surface** ignition systems (**HSI**) have been used for more than twenty years for **gas ignition in units such as gas clothes dryers, gas ovens, gas fired furnaces, and boilers** thus replacing and eliminating standing gas pilot lights. Low voltage ignitors (12 and 24 volts) of the **hot surface** type are made from a patented ceramic/intermetallic material. These ignitors were used in compact low wattage assemblies for gas fired ignition. The element **reaches ignition temperature in less than 3-5 seconds** and utilizes about 40 watts of power. The ignitor is made from a composite of strong oxidation resistant ceramic and a refractory intermetallic. Thus **hot surface** ignitors have no flame or spark. They simply heat to the required temperature for igniting a fuel air mixture. Such ignitors have not been used in oil burning systems because the ignitor material is porous and oil entering the porous cavities causes buildup of the materials that are inimical to the operation of the burner.
>
> (12) A 100 to 240 V **HSI** ignitor has been developed in which the material is compressed and **sintered** to full density leaving no porosity resulting in a high performance ceramic composite. It can operate at very high temperatures such as 1,300.degree. to 1,600.degree. C. The application of such high voltage **hot surface**

ignition device is especially attractive for use in the present invention wherein oil fuel burning heaters are to be constructed. They provide unique advantages over prior art gas flames, heating coils, and spark gap ignition systems.

US003589846 (Place) shows and discloses gas control system that:

- controls energizing an ceramic electric resistance igniter (23) from a power source;
- a switching mechanism (42,52) connected between the electric resistance igniter and the power (L1, l2);
- the electric resistance igniter responsive to an input signal from door and timer switches (42, 49);
- wherein the control device controls operation of the electric resistance igniter (23) so as to warm-up the electric resistance igniter to a temperature at or above an ignition temperature for a gas being combusted; and
- wherein following successful ignition of the gas, operation of the electric resistance igniter is controlled so the electric resistance igniter is at a temperature less than the gas ignition temperature so the electric resistance igniter can be re-heated so as to re-ignite the gas within a desired re-ignition time period. In this regard **US003589846 (Place)** discloses **(see column 5, lines 28-34)**.

> "… The igniter can cause ignition when its temperature is above **$1{,}400^{0}$ F. to $1{,}600^{0}$ F**." **(column 4, lines 62-69)**
>
> "If ignition occurs properly, sufficient heat is radiated by the flame and the igniter 23 to hold the switch 58 open. In the illustrate embodiment, the **igniter drops to about 1000^{0} F**, when equilibrium is reached after ignition occurs. **This temperature is maintained in the igniter** by the presence of the flame **and the low voltage applied to the igniter.**"

US003589846 (Place) discloses a controlling operation of the igniter so the igniter is at a temperature less than the ignition temperature but above room temperature and within 600^{0} C of the gas ignition temperature. The ignition of the fuel in **US003589846 (Place)** occurring at "**above $1{,}400^{0}$ F. to $1{,}600^{0}$ F**." **(760^{0} C to 871^{0} C)** and the temperature at which igniter is maintained after ignition occurs being a temperature of "**about 1000^{0} F**" **(538^{0} C).**

EP000385910B1 teaches, from the same appliance control field of endeavor as **US003589846 (Place)**, using a micro-controller (M1) and an applications program for execution in the micro-controller including instructions and criteria for outputting control signals to a switching mechanism to selectively control voltage and current being applied to an electric resistance igniter.

US005660043 (Pfefferle et al) shows and discloses gas control system that:

- controls energizing an ceramic electric resistance igniter (30) from a power source (not shown);
- a switching mechanism (not shown) connected between the electric resistance igniter and the power;
- wherein the control device controls operation of the electric resistance igniter **(column 4, lines 15-30)** so as to warm-up the electric resistance igniter to a temperature at or above an ignition temperature for a gas being combusted; and
- wherein following successful ignition of the gas, operation of the electric resistance igniter is controlled so the electric resistance igniter is at a temperature less than the gas ignition temperature so the electric resistance igniter can be re-heated so as to re-ignite the gas within a desired re-ignition time period. **(column 4, lines 15-30)**

US004418661 (Esper) and **US004762982 (Ohno et al)** separately and collectively teach sintered ceramic electric resistance ignition elements are known to be used widely as an ignition source for various combustion and heating apparatuses, can quickly raise temperature, can be used for an extended period of time regardless of environmental conditions and is superior in ignition reliability and safety (e.g.- US005233166 (Maeda et al); sintered ceramic electric resistance ignition heaters (glow plugs) are known to quickly achieve preheat temperature necessary to ignite fuel vapor-air mixture “in less than <u>1</u> second” (see US004418661 (Esper)) and “for example to about 900.degree. C. in about <u>three</u> seconds” (see US004762982 (Ohno et al)).

<u>**US004418661**</u> <u>**(Esper)**</u> discloses:

(11) Embodiment of <u>**FIGS. 3 and 4**</u>: <u>**The glow plug heater 24'--FIG. 4--is a particularly desirable construction when**</u> <u>**fast preheating**</u> <u>**is important.**</u> The <u>**glow plug body 17'**</u> has a <u>**ceramic tube 20'**</u> with a flange 18' and a bottom 21', for incorporation into a socket, for

example as illustrated in FIG. 1; this portion of the structure is basically similar to that shown in FIGS. 1 and 2. The outer surface of the bottom 21' of **ceramic tube 20'** has a heat conductive layer 42 applied thereto in accordance with any known method, and made, for example, of a platinum/aluminum oxide layer. The purpose of the heat conductive layer is to prevent excessive temperature gradients in the densely **sintered ceramic** tube **20'**. This is accomplished by distributing heat which, in accordance with the particular heater construction, is concentrated essentially at only a single point. The heater element 24' is so constructed that heat is generated over only a very small area thereof. The heat conductive layer distributes the heat from this point-source over a wider area of the bottom 21'. The heat conductive layer 42 may be made of various metal/**ceramic compounds**, but preferably contains a metal which is platinum, a platinum metal, or alloys of platinum metal.

17) **Glow plugs** constructed with a **glow body 17'** in accordance with FIGS. 3 and 4 can reach the temperature necessary to ignite fuel vapor-air mixture **in less than 1 second**. The requisite temperatures can be reached with glow plug bodies 17' **even if the applied voltage has dropped from a nominal voltage level of 12 V to a level in the order of about 9 V in 1.5 seconds, or less**; the **power consumption is only half** that as in known glow plugs utilizing a thin-walled metallic glow plug housing within which a resistance wire is placed, embedded in a ceramic material.

US004762982 (Ohno et al) discloses:

5) **Conventionally**, **high voltage V.sub.1** is applied in the initial current supplying period to abruptly heat the **ceramic** **glow plug** for a diesel engine, for example to about **900.degree. C**. in **about** **three** **seconds** after every starting of the engine as shown in FIG. 12. When the temperature of the glow plug reaches about 900.degree. C. (at which temperature the **sintered** body of the glow plug is not cracked and the glow plug can perform ignition), **low voltage V.sub.2 is applied to maintain the stable saturation temperature (about 1,150.degree. C.).** Then current supply is stopped. In this way, one cycle is completed to facilitate the starting of the diesel engine.

(42) **Ceramic** of the **ceramic heaters** **used** for the present invention is non-oxided ceramic such as silicon nitride (Si.sub.3 N.sub.4) or oxided ceramic such as alumina (Al.sub.2 O.sub.3). The current supply method of the present invention can be applied to heaters made of these **numerous** **ceramic** **sintered** **bodies**.

USPTO CUSTOMER COPNTACT INFORMATION

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Carl D. Price whose telephone number is (571) 272-4880. The examiner can normally be reached on Monday through Friday between 9:00am-5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven B. McAllister can be reached on (571) 272-6785. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.Information

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